

ART. XIX.—*The Northward Extension of the Derrinal Conglomerate (Glacial).*

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So much interest has been aroused in all that pertains to the evidence of ancient glaciation in Australia and elsewhere, and every additional fact developed excites such keen attention that it is a pleasure to record some new localities.

On the 1st of November last a very interesting locality came under observation near the northern boundary of New South Wales, latitude about 29° S. It is at the Ashford Coal Field, Fraser's Creek Station, Severn River, Arrawatta County. The Derrinal Conglomerate forms the basal beds of the Ashford Coal Field.

At Fraser's Creek homestead granite outcrops on the west side of the river Severn, and strewn over this are numerous pebbles and boulders of many varieties of porphyry, granite, etc., derived from the glacial conglomerate which has been denuded at this site. Scratched surfaces are plentiful and the variety of pebbles, unlike any in place within the present watershed of the Severn, are characteristics of the Derrinal Conglomerate. The hard porphyry boulders have retained the scratches best of all; a specimen of these is exhibited.

About two miles south from the homestead is Coal Gully where a few hundred tons of coal have been mined, and along which the section is made. To the east are brown shales and sandstones, much buckled and disturbed, these are referred to by the N. S. Wales geologists as Carboniferous Strike, N. 10 W. Dip easterly 20° . Pitch at junction with the conglomerate N. 23° . On the upturned edges of these Carboniferous (?) rocks the Derrinal Conglomerate was laid down and then succeeded in a conformable manner to the conglomerate, black shales, grey shale, a coal seam, then thick bedded sandstone, etc. At this site the

conglomerate is represented by small, subangular fragments of claystone in a light grey clayey matrix, with bands of ferruginous character near the floor, total thickness of the conglomerate 22 feet. Above the conglomerate is 13 feet of black shale, then 9 feet of black shale and impure coal (bass), then 4 feet of black shale and 1 foot of grey shale full of Gangamopteris and other plant-remains, then $7\frac{1}{2}$ feet of black shale and dirty coal. Above this is a massive coal seam 27 feet thick, covered by light grey false-bedded sandstone with plant impressions. Further westward Post Pliocene deposits obscure the older rocks for about one chain, then yellowish-grey sandstones again crop out. Two hundred yards further west granite occurs, and this forms a range running N. and S. for some miles. The Derrinal Conglomerate and conformable overlying shales, coal, etc., all dip westward at about 56° , and as they were probably laid down in a more nearly horizontal manner a fault is indicated apparently near their junctions with the granite. The granite is older than the conglomerate, as proved at Cherry Gully Railway Station, Queensland.

This remarkable coal seam was reported upon by Professor David in 1883 and by Mr. Pittman, Govt. Geologist, in 1896,¹ but the interesting nature of the conglomerate associated with it appears to have escaped notice.

The practical importance of this section in which the Derrinal Conglomerate is associated with a thick and valuable seam of coal is not confined to Australia alone, for in South Africa the corresponding glacial conglomerate (which I named "Dwyka Conglomerate," after a site where it is characteristically represented) is associated with black and coloured shales as at Ashford Coal Field. Glossopteris, Gangamopteris, etc., occur in the shales just above the the glacial conglomerate both in South Africa and in Australia, and sub-Karoo coal seams will no doubt be found that will correspond with the Ashford seam.

In the Quarterly Journal of the Geological Society (London), Vol. LIII, Part 3, No. 211, p. 310 *et seq.*, August, 1897, a paper is published by Mr. David Draper on the occurrence of Glossopteris, Gangamopteris, etc., associated with coal seams at

¹ Records Geological Survey of N. S. Wales, vol. v., part i., page 26.

Boschman's Fontein, Maggie's Fontein, etc. Transvaal sections are given at pp. 312 and 313. "Boulder beds" are mentioned and shewn, and these are probably Dwyka Conglomerate and the overlying beds containing the coal seams and *Glossopteris*, etc., are doubtless conformable with the "boulder beds." The resemblance of these Transvaal occurrences to the Ashford coal and its associated glacial conglomerate and fossiliferous shales is most striking. The Ashford coal measures undoubtedly represent the lowest horizon of coal bearing beds in New South Wales on the Greta coal measures.

The coal seams and fossils occurring above and below them, as described by Mr. Draper, correspond with the Ashford horizon and therefore belong to the lower coal measures of South Africa—the Kimberley shale horizon—and not to the Molteno coal measures of the Stormberg series, which are much higher in the geological scale. The Molteno coal measures are characterised by *Taeniopteris*, *Odontopteris*, *Zamites*, etc., in great abundance; a very characteristic feature of these fossil ferns is that the stems bifurcate. The Molteno coal measures correspond with the upper coal measures of New South Wales, the Warwick coal measures of Queensland, and the coal measures of N. E. Tasmania.

If the Boschman's Fontein and other coal deposits described by Mr. Draper as associated with *Glossopteris*, *Gangamopteris*, etc., belong to the Kimberley shales horizon then the sub-Karoo coal seams are proved absolutely to exist.

In the shales associated with the faulted coal at Rabie's Farm, Camdeboo, *Glossopteris*, *Equisetæ* and perhaps *Gangamopteris*, were found. These fossils are found in the Kimberley shales at several points, but never associated with the Molteno coal measures.

To revert to the Ashford locality, there is, about $\frac{1}{2}$ mile south of Coal Gully, another small gully running east into the Severn River, called Sheepskin Gully. About $\frac{1}{4}$ mile from the river up the gully, the Derrinal Conglomerate occurs resting unconformably upon the upturned edges of the carboniferous (?) beds, these latter dip E. 66° , while the glacial conglomerate dips W. 26° . At this point the conglomerate consists of small pebbles having characteristic glaciated forms, some showing striations; they are

principally of claystone¹, but there are odd examples of well rounded lydianite, porphyry, granite, etc., also the conglomerate beds are rudely stratified and are interbedded with well stratified shales and sandstones. In some of these beds *Glossopteris* and other plant-remains are abundant. At one point on the N. side of the gully, a little coal was observed, but whether this was a loose block or not is uncertain. The gully bifurcates a few chains further up from where the conglomerate shews nearest the river, and after a few chains more of conglomerate, shales and sandstones are traversed in a westerly direction, the Carboniferous (?) beds again occupy the surface. The width of conglomerate and alternating beds here would be about 12 chains from E. to W. The beds all dip at low angle to the W., but whether this is due to a kind of false bedding or whether to subsequent faulting remains to be worked out. West at a short distance is granite, south one mile is an outcrop of Gympie Beds, shales, and sandstones, highly inclined and traversed by a mineralized quartz vein. Newer than these are the Carboniferous (?), sandstones and shales which are free of quartz veins. On the upturned edges of these Carboniferous (?) beds is the glacial conglomerate and associated shales, sandstones and coal seams. Again on the upturned edges of the Derrinal Conglomerate and associated beds which dip at angles ranging from 26° to 56° to the W., is a Post Pliocene deposit a few feet thick, consisting of soft loose grit, and this in turn is covered by Recent surface soil from 1 to 3 feet thick.

An immense area of Derrinal Conglomerate must have been denuded to supply the great pebble beaches along the Severn River with material so unlike any rocks now existing within its present watershed.

In Queensland the Derrinal Conglomerate is well shewn resting on granite at Cherry Gully Railway Station, 187 miles south of Brisbane; it is observable in the cuttings along the line for over a mile in length. The pebbles where weathered out, are of the usual glacial character and of many varieties of rocks, some show distinct scratches. The matrix is granitic detritus.

¹ Literally not felspathic porphyry.

At Silver Wood Railway Station, 179 miles from Brisbane, nearly horizontal glacial conglomerate rests on the upturned edges of the much contorted Carboniferous (?) beds. Here the pebbles are of a great variety of rocks glaciated in form and in some cases polished and scratched. As at the Ashford locality the conglomerate rests on Carboniferous (?) beds, but the overlying shales, etc., were not observed. The conglomerate continues for some miles further northward along the railway towards Warwick. Similar deposits of the Derrinal Conglomerate should be found still further north, both E. and W. of the Dividing Range. If the occurrence of the same conglomerate in South Africa (the Dwyka Conglomerate) is any guide then the Derrinal Conglomerate may be looked for at intervals right round Australia at the base of the Permo-Carboniferous, and later rocks that occupy so great an area of the interior of the continent.

Apart from the scientific interest which centres in the Derrinal Conglomerate as a geological bench-mark connecting Australasia with South Africa and possibly with Asia, and from the speculation it excites as to what conditions could have prevailed to produce a conglomerate so protean in its aspects, there is the very practical fact that the Derrinal Conglomerate forms the floor of all our valuable coal seams, and, what is almost as important in this droughty land, also the floor of the strata from which artesian water is obtainable.
